

***Amendments to the Claims***

This listing of claims will replace all prior versions, and listings of claims in the application.

Claims 1-7. (Cancelled)

8. (New) A computer system, comprising:

a memory;

a superscalar microprocessor for processing instructions; and

a bus coupled between the memory and the microprocessor;

wherein the microprocessor includes:

an instruction fetch unit configured to fetch instructions from an instruction store according to a sequential program order;

an instruction buffer coupled to receive fetched instructions from the instruction fetch unit and configured to make a plurality of fetched instructions concurrently available for execution;

a plurality of functional units configured to execute instructions, thereby generating result data;

a register file including a plurality of entries configured to store data including result data generated by the plurality of functional units, wherein each of

the plurality of entries is accessible by reference to a respective location in the register file;

a decoder circuit configured to concurrently identify execution resources for more than one of the plurality of available instructions in the instruction buffer, the identified execution resources for each of the available instructions including a functional unit capable of executing the instruction and a register file entry corresponding to a source of an operand for the instruction;

an issue control circuit coupled to the decoder circuit and configured to concurrently issue more than one of the instructions from the instruction buffer to the functional units for execution, based on availability of the execution resources identified by the decoder circuit and without regard to the sequential program order;

a plurality of data routing paths coupled between the plurality of functional units and the register file and configured to concurrently transfer result data from more than one of the plurality of functional units to the register file;

bypass control logic coupled to the plurality of data routing paths and configured to supply result data from a first one of the plurality of functional units as operand data for another one or more of the plurality of functional units via an alternate data path that bypasses the register file, wherein supplying result data via the alternate data path occurs concurrently with transferring result data to the register file; and

retirement control logic coupled to the register file and configured to concurrently retire a plurality of instructions according to the sequential program order.

9. (New) The system of claim 8, wherein:

the plurality of functional units includes an integer functional unit and a floating-point functional unit; and

the bypass control logic is further configured such that an integer result from the integer functional unit is transferred to the floating-point functional unit via the alternate data path.

10. (New) The system of claim 8, wherein:

the plurality of functional units includes an integer functional unit and a floating-point functional unit; and

the bypass control logic is further configured such that a floating-point result from the floating-point functional unit is transferred to the integer functional unit via the alternate data path.

11. (New) The system of claim 8, wherein the microprocessor further includes:

operand data routing paths coupled between the register file and the functional units and configured to concurrently transfer operand data to more than one of the functional units.

12. (New) The system of claim 11, wherein the operand data routing paths transfer operand data directly from the register file to the functional units.

13. (New) The system of claim 8, wherein the register file includes:

a temporary buffer having a first plurality of entries; and

a retired register array having a second plurality of entries;

wherein the retirement control logic is further configured such that when an instruction is retired, corresponding result data is transferred from the temporary buffer to the retired register array.

14. (New) A superscalar microprocessor for processing instructions, the microprocessor comprising:

an instruction fetch unit configured to fetch instructions from an instruction store according to a sequential program order;

an instruction buffer coupled to receive fetched instructions from the instruction fetch unit and configured to make a plurality of fetched instructions concurrently available for execution;

a plurality of functional units configured to execute instructions, thereby generating result data;

a register file including a plurality of entries configured to store data including result data generated by the plurality of functional units, wherein each of the plurality of entries is accessible by reference to a respective location in the register file;

a decoder circuit, disposed at a stage subsequent to said instruction buffer, configured to concurrently identify execution resources for more than one of the plurality of available instructions in the instruction buffer, the identified execution resources for each of the available instructions including a functional unit capable of executing the instruction and a register file entry corresponding to a source of an operand for the instruction;

an issue control circuit coupled to the decoder circuit and configured to concurrently issue more than one of the instructions from the instruction buffer to the functional units for execution, based on availability of the execution resources identified by the decoder circuit and without regard to the sequential program order; and

retirement control logic coupled to the register file and configured to retire a plurality of instructions according to the sequential program order.

15. (New) The microprocessor of claim 14 wherein:

the plurality of functional units includes an integer functional unit and a floating-point functional unit.

16. (New) The microprocessor of claim 14, further comprising:

operand data routing paths coupled between the register file and the functional units and configured to concurrently transfer operand data to more than one of the functional units.

17. (New) The microprocessor of claim 14 wherein the register file includes:

a temporary buffer having a first plurality of entries; and

a retired register array having a second plurality of entries;

wherein the retirement control logic is further configured such that when an instruction is retired, corresponding result data is transferred from the temporary buffer to the retired register array.

18. (New) A method for processing instructions in a superscalar microprocessor, the method comprising:

fetching instructions from an instruction store according to a sequential program order;

making a plurality of fetched instructions concurrently available in an instruction buffer for execution;

concurrently identifying execution resources, by a decoder circuit disposed at a stage subsequent to said instruction buffer, for more than one of the plurality of available instructions in the instruction buffer, the identified execution resources for each of the more than one of the plurality of available instructions including a functional unit capable of executing the instruction and a register file entry corresponding to a source of an operand for the instruction;

concurrently issuing more than one of the plurality of available instructions from the instruction buffer for execution by a plurality of functional units, based on availability

of the identified execution resources for each instruction and without regard to the sequential program order;

executing the issued instructions in the plurality of functional units, thereby generating result data;

transferring the result data from the functional units to a register file, the register file including a plurality of entries, wherein each of the plurality of entries is accessible by reference to a respective location in the register file; and

retiring instructions according to the sequential program order.

19. (New) The method of claim 18 wherein:

the plurality of functional units includes an integer functional unit and a floating point functional unit.

20. (New) The method of claim 18, further comprising:

concurrently transferring operand data from the register file to more than one of the functional units via a plurality of operand data routing paths.

21. (New) The method of claim 18 wherein the register file includes:

a temporary buffer having a first plurality of entries; and

a retired register array having a second plurality of entries;

wherein the retiring an instruction includes transferring corresponding result data from the temporary buffer to the retired register array.

22. (New) A high-performance RISC microprocessor for executing an instruction obtained from an instruction store, comprising:

a fetch circuit for fetching the instruction from the instruction store;

a buffer, disposed at a stage subsequent to said fetch circuit, for buffering a plurality of instructions;

a decoder, disposed at a stage subsequent to said buffer, for simultaneously decoding the plurality of instructions; and

an execution circuit, disposed at a stage subsequent to said decoder, which is capable of executing the instructions out of order,

said execution circuit comprising:

a register file for storing data in a plurality of registers; and

a plurality of functional unit for processing the data in a predetermined way.

23. (New) The high-performance RISC microprocessor of claim 22, further comprising a retirement circuit for arranging the plurality of instructions out of the program order into the program order.

24. (New) The high-performance RISC microprocessor of claim 22, wherein the instruction store is coupled to a cache.



25. (New) The high-performance RISC microprocessor of claim 22, further comprising a register renaming circuit coupled to said functional unit and to said register file.

26. (New) A high-performance RISC microprocessor, which is a superscalar microprocessor, for executing an instruction obtained from an instruction store, comprising:

    a fetch circuit for fetching a plurality of instructions in a program order from the instruction store;

    a buffer disposed at a stage subsequent to said fetch circuit for buffering the plurality of instructions;

    a dispatch circuit for simultaneously decoding the plurality of instructions and for dispatching them; and

    an execution unit including a plurality of functional units for executing the instructions dispatched by said dispatch circuit out of the program order, and a register file for storing execution results of said plurality of functional units.

27. (New) The high-performance RISC microprocessor according to claim 26, further comprising a retirement circuit for arranging the plurality of instructions out of the program order into the program order.

28. (New) The high-performance RISC microprocessor according to claim 26, wherein said dispatch circuit includes a issue circuit for issuing the instructions out of the program

order to said execution unit under the condition of the usability of said plurality of functional units.

29. (New) The high-performance RISC microprocessor according to claim 26, wherein the instruction store is coupled to a cache.

30. (New) The high-performance RISC microprocessor according to claim 26, further comprising a register renaming circuit coupled to said functional unit and to said register file.

31. (New) A computer system, comprising:

- a memory;

- a superscalar microprocessor for processing instructions; and

- a bus coupled between the memory and the microprocessor;

- wherein the microprocessor includes:

  - an instruction fetch unit configured to fetch instructions from an instruction store according to a sequential program order;

  - an instruction buffer coupled to receive fetched instructions from the instruction fetch unit and configured to make a plurality of fetched instructions concurrently available for execution;

  - a plurality of functional units configured to execute instructions, thereby generating result data;

a register file including a plurality of entries configured to store data including result data generated by the plurality of functional units, wherein each of the plurality of entries is accessible by reference to a respective location in the register file;

a decoder circuit, disposed at a stage subsequent to said instruction buffer, configured to concurrently identify execution resources for more than one of the plurality of available instructions in the instruction buffer, the identified execution resources for each of the available instructions including a functional unit capable of executing the instruction and a register file entry corresponding to a source of an operand for the instruction;

an issue control circuit coupled to the decoder circuit and configured to concurrently issue more than one of the instructions from the instruction buffer to the functional units for execution, based on availability of the execution resources identified by the decoder circuit and without regard to the sequential program order; and

retirement control logic coupled to the register file and configured to retire a plurality of instructions according to the sequential program order.

32. (New) The computer system of claim 31 wherein:

the plurality of functional units includes an integer functional unit and a floating-point functional unit.

33. (New) The computer system of claim 31, further comprising:

operand data routing paths coupled between the register file and the functional units and configured to concurrently transfer operand data to more than one of the functional units.

34. (New) The computer system of claim 31 wherein the register file includes:

a temporary buffer having a first plurality of entries; and

a retired register array having a second plurality of entries;

wherein the retirement control logic is further configured such that when an instruction is retired, corresponding result data is transferred from the temporary buffer to the retired register array.

35. (New) A computer system, comprising:

a memory;

a high-performance RISC microprocessor for executing an instruction obtained from an instruction store; and

a bus coupled between the memory and the microprocessor;

wherein the microprocessor includes:

a fetch circuit for fetching the instruction from the instruction store;

a buffer, disposed at a stage subsequent to said fetch circuit, for buffering a plurality of instructions;

a decoder, disposed at a stage subsequent to said buffer, for simultaneously decoding the plurality of instructions; and

an execution circuit, disposed at a stage subsequent to said decoder, which is capable of executing the instructions out of order,

said execution circuit comprising:

a register file for storing data in a plurality of registers; and

a plurality of functional unit for processing the data in a predetermined way.

36. (New) The computer system of claim 35, wherein the microprocessor further comprising a retirement circuit for arranging the plurality of instructions out of the program order into the program order.

37. (New) The computer system of claim 35, wherein the instruction store is coupled to a cache.

38. (New) The computer system of claim 35, further comprising a register renaming circuit coupled to said functional unit and to said register file.

39. (New) A computer system, comprising:

a memory;

a high-performance RISC microprocessor, which is a superscalar microprocessor, for executing an instruction obtained from an instruction store; and

a bus coupled between the memory and the microprocessor;

wherein the microprocessor includes:

a fetch circuit for fetching a plurality of instructions in a program order  
from the instruction store;

a buffer disposed at a stage subsequent to said fetch circuit for buffering  
the plurality of instructions;

a dispatch circuit for simultaneously decoding the plurality of instructions  
and for dispatching them; and

an execution unit including a plurality of functional units for executing the  
instructions dispatched by said dispatch circuit out of the program order, and a  
register file for storing execution results of said plurality of functional units.

40. (New) The computer system of claim 39, wherein the microprocessor further  
comprising a retirement circuit for arranging the plurality of instructions out of the  
program order into the program order.

41. (New) The computer system of claim 39, wherein said dispatch circuit includes a  
issue circuit for issuing the instructions out of the program order to said execution unit  
under the condition of the usability of said plurality of functional units.

42. (New) The computer system of claim 39, wherein the instruction store is coupled to a  
cache.

43. (New) The computer system of claim 39, wherein the microprocessor further comprising a register renaming circuit coupled to said functional unit and to said register file.